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if a specimen is mounted in olive oil. The excretion of water from the cells soon begins and a cylinder of ice is formed about the filament.

As a result of the work upon unicellular structures in many organisms, it is found that the freezing may be accompanied by the formation of ice in the cell, external to the cell membrane or in both places. In either case it is accompanied by a more or less complete separation of the water from the plasma. The exposure of tissues with strongly developed walls to low temperatures was accompanied by the excretion of ice into the intercellular spaces, followed by the formation of ice both here and in the cell. Not all the cells of a plant exhibit the same resistance to cold. A temperature of a few degrees below zero Centigrade may freeze a leaf while the guard cells and hairs will remain intact. These cells are likewise highly resistant to heat and other agencies, as Leitgeb has previously demonstrated.

The question as to the death of a plant upon freezing or consequent thawing has engaged the attention of a large number of workers. Molisch's results prove that generally the death of a plant is due to the direct action of cold upon the plasma, and that the consequent thawing does not matter whether slow or rapid, in air or water. To this generalization an exception is offered by the experience of Müller-Thurgau, who found that frozen fruits of the apple and pear were not destroyed if thawed slowly, a fact long known in household practice, and the experiment of Molisch with *Agave americana*, which behaved in a similar manner. These exceptions, of course, rest upon the provision that the temperature has not fallen below a certain limit.

The death of plants from temperatures above the freezing point may result from disturbances of the metabolic processes or the transpiratory activity. In the latter instance the 'frosting' of a plant is due to the decreased osmotic activity of the root hairs under low temperatures, and wilting of the leaves consequent upon an insufficient supply of water. Dr. Molisch is mistaken in attributing the origin of this idea to Krabbe, as the principle has been known for many years, although its detailed application was first exploited by Krabbe.

Among the plants which are killed by low temperatures above freezing point, the most delicately responsive are *Episcia discolor* Hook., *Sanchezia nobilis* Hook., *Eranthemum tricolor* Nichols., *E. couperi* Hook., *E. igneum* Linden., *Anæctochilus setaceus* Blume. The species in this list exhibit damage after exposure to temperatures 1.4° C. to 3.7° C. for periods of 18 to 100 hours. *Begonia stigmatisata*, *B. scandens*, *Bæhmeria argentea* Linden, *Tradescantia discolor*, *T. zebrina*, and *Euphorbia splendens*, *Ficus elastica*, *Gloxinia hybrida*, *Tropeolum majus*, are examples of a numerous class which are injured by longer exposure to the same temperature. It is to be seen that Molisch's carefully attained results sustain the contention of Goepfert and Müller-Thurgau that death from freezing is due to the formation of ice or to the direct influence of cold, and not to the processes of thawing as maintained by Sachs. The formation of ice entails the excretion of water from the protoplasm, and the great and rapid loss of the fluid results in the architectural disintegration of the plasma. The disintegration may be hastened by the poisonous action of concentrated cell-sap remaining.

So far as the results are at hand, it is to be said that the excretion of water by cells at low temperatures is not only a physical reaction, but this action has become under the direction of the protoplasm a protective adaptation. A second adaptation consists in the smallness of the cell.

D. T. MACDOUGALL.

SOCIETIES AND ACADEMIES.

BOSTON SOCIETY OF NATURAL HISTORY.

THE Society met December 1st; thirty-five persons present. Professor N. S. Shaler, in discussing Aeolian deposits in relation to the formation of river valleys, gave the result of his observations in Utah and Montana. Along the Ruby river, where the vegetation is dense and the soil rich, the loess is held and the valley built up. In Montana below 7,000 feet the vegetation is thin and insufficient to inhibit.

Mr. A. W. Grabau showed some fossils from the upper Devonian of western New York, and gave the views taken by various investigators as to the nature of Conodonts, since their discovery by Pander in the Silurian and Devonian

rocks of Russia. Mr. Grabau's studies confirm the position taken by Zittel and Rohon that these minute tooth-like fossils are the jaws of worms. He also discussed the relations of *Styliolina*, *Cardiola* and *Clymenia*, and the close parallelism between American and European *Goniatites*. Professor Hyatt took exception to Hinde's view, quoted by Mr. Grabau, as to the unity of the American and European forms; the late American faunas are residual; they do not originate types; the very ancient American faunas may be, however, originating faunas.

Dr. Jackson drew attention to the large numbers of associated fossils in very small space, and Mr. Grabau stated that Clark's investigations proved the identity of the American and European species.

SAMUEL HENSHAW,
Secretary.

THE TORREY BOTANICAL CLUB, NOVEMBER 9,
1897.

THE paper of the evening, by Mrs. E. G. Britton, a description of two new species of *Ophioglossum* will be printed in the *Bulletin*. The paper also discussed the affinities, range and type characters of our Eastern species of *Ophioglossum*, with keys and specific descriptions, and with exhibition of tracings and numerous mounted specimens.

Dr. Underwood sketched the characteristics of the four distinct types of *Ophioglossum* as: 1st, the section typified by *O. vulgatum* and discussed in the paper; 2d, that by *O. palmatum* of tropical America, which extends into Florida, there growing directly under the crown of the palmetto trees, nestled among the leaf-shrubs; 3d, that typified by *O. pendulum*, found in the Hawaiian Islands and Pacific regions, which is also pendulous from trees and produces a stipe attached almost to the middle of the leaf. In the 4th section, with growth not over one inch high, the sterile and fertile fronds are distinct to the rooting base.

Dr. Underwood further remarked the necessity of experience to discover forms of *Ophioglossum*, especially such as *O. crotalophoroides*, only one inch high, collected by him in Alabama.

Mr. Clute spoke of the great diversity in size displayed by *O. vulgatum* in a single locality.

Professor Burgess referred to the occasional occurrence of *O. vulgatum* with its own namesake *Pogonia ophioglossoides*, and to other companion-plants with which he finds *Ophioglossum* associated in growth, as *Chiogenes* and especially the orchids *Microstylis ophioglossoides*, *Habenaria hyperborea* and *H. dilatata*.

Dr. Underwood then exhibited photographs of the Kew Gardens, with reminiscences of his visit of last summer. He spoke particularly of their formal decoration, dating back to royal use, and the photographs shown included one of 'Queen Mary's Elm,' planted by her about 1555, once 25 feet in girth, now represented chiefly by a series of shoots.

EDWARD S. BURGESS,
Secretary.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

At the meeting of the Academy of Science of St. Louis on December 20, 1897, twenty-five persons present, Dr. R. J. Terry exhibited several specimens of human humerus, showing supracondylar process associated with high division of the brachial artery, which was contrasted with similar processes that have been observed in the anthropoid apes and the lower monkeys, and with a similarly situated foramen of the arm of the *Felidae*. It was stated that while a slight roughness was observed, at the point indicated, in a majority of ninety-six specimens observed, the structure was fairly developed in four out of this number, in all cases on the left arm.

Professor F. E. Nipher presented a paper describing a long series of experiments made to determine the distribution of pressure over a pressure board, and summarizing the results reached.

WILLIAM TRELEASE,
Recording Secretary.

NEW BOOKS.

A Genealogy of Morals. FRIEDRICH NIETZSCHE. Translated by WILLIAM A. HAUSEMANN. New York and London, The Macmillan Company. 1897. Pp. xix+289. \$2.

The Social Mind and Education. GEORGE EDGAR VINCENT. New York and London, The Macmillan Company. 1897. Pp. 146. \$1.25.